



Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at <http://about.jstor.org/participate-jstor/individuals/early-journal-content>.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

of the period 1910-1916, but above the January, 1920, rate. Allowing for these conditions, and plotting the two sets of rates as well as the percentages of increase from week to week, the indications at this writing are that the 1920 epidemic in Chicago and Milwaukee, for example, is following the 1918 epidemic very closely, both in its course and in its severity; but that in New York and Washington, for example, the course of the two epidemics is fairly similar, although the 1920 epidemic is not nearly so severe.

With certain exceptions, the present epidemic so far has shown itself to be of decidedly less serious aspect than the one of 1918, using the excess mortality rate as the measure of severity. The highest death rates in the 1918 epidemic were reached in most cities in four weeks from the date on which the epidemic first manifested itself in the respective cities; so that, according to this experience and in view of the general similarity of the curves up to this time, a decline may be expected in Chicago, New York, and perhaps other cities, in the next week or two. It will then be possible to form a more accurate estimate of the course and of the severity of this epidemic in other cities where it is not yet at or near its maximum.

With respect to the spread of the present epidemic in the first three weeks, a comparison with the area of extension of the 1918 epidemic indicates that the two are very nearly on a parity.

OCCURRENCE OF MALARIA AND ANOPHELINE MOSQUITOES IN MIDDLE AND SOUTHERN CALIFORNIA.

By WILLIAM B. HERMS, Associate Professor of Parasitology, University of California, and Consulting Entomologist of the California State Board of Health.

A State-wide malaria-mosquito survey of California was begun in the spring of 1916¹ and carried on during the summer of that year and a portion of the following summer (1917) when the work was interrupted on account of the war. This survey was again taken up in 1919, and was completed during the summer of that year. A report of the work done during 1916 in the northern third of the State has already been published;² this report presents a summary of the work done in the middle and southern portions of the State.

The survey of the northern third of the State covered 31 counties, and resulted in a total of 289 mosquito collections, consisting of 2,769 specimens, of which 38 per cent were anopheline mosquitoes (62.8 per cent *A. quadrimaculatus*, 15.1 per cent *A. punctipennis*,

¹ Herms, William B., A State-wide Malaria-Mosquito Survey of California: Journ. Econ. Entomology, vol. 10, No. 3, pp. 359-370, 1917.

² Herms, William B., Occurrence of Malaria and Anopheline Mosquitoes in Northern California: U. S. Public Health Reports, vol. 34, No. 29, July 18, 1919, pp. 1579-1587.

and 22.1 per cent *A. pseudopunctipennis*). The average annual malaria death rate for the 10-year period, 1909-1918, for these counties was 4.9 per 100,000 population.

The survey of the middle portion of the State covered 20 counties extending from the southern border of El Dorado, Sacramento, Contra Costa, Alameda, and San Mateo Counties, to the Tehachapi Mountains, and including the following counties, grouped to accord more or less with the arrangement of the northern counties:

A. San Joaquin Valley counties: Fresno, Kern, Kings, Madera, Merced, San Joaquin, Stanislaus, Tulare.

B. Sierra counties: Amador, Calaveras, Tuolumne, Mariposa.

C. Plateau counties: Alpine, Inyo, Mono.

D. Coastal counties: Monterey, San Benito, San Luis Obispo, Santa Clara, Santa Cruz.

A total of 213 mosquito collections were made during the survey of these counties, consisting of 2,806 mosquitoes, of which 31.1 per cent were anophelines (46 per cent *A. quadrimaculatus*, 10.9 per cent *A. punctipennis*, and 43.1 per cent *A. pseudopunctipennis*). The average annual malaria death rate for the 10-year period, 1909-1918, for these middle California counties was 4.7 per 100,000 population.

The following counties comprise that portion of the State designated as southern California in this report:

A. Coastal counties: Los Angeles, Orange, Riverside, Santa Barbara, San Diego, Ventura.

B. Desert counties: Imperial, San Bernardino.

A total of 71 mosquito collections were made in southern California (8 counties), consisting of 814 mosquitoes, of which 49.6 per cent were anophelines (30.5 per cent *A. quadrimaculatus*, 0.2 per cent *A. punctipennis* and 69.3 per cent *A. pseudopunctipennis*). The average annual malaria death rate for the 10-year period, 1909-1918, for this portion of the State was 0.9 per 100,000 population.

The malaria death rate by counties, as well as the occurrence of mosquitoes, is presented in the following tables:

TABLE I.—*Number of deaths from malaria, and average annual death rate per 100,000 population for middle California for 10 years, 1909-1918, inclusive.*

| | Population. ¹ | | | Deaths from malaria. | | | Malaria death rate per 100,000 population (annual). | | |
|------------------------------|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---|----------------------|----------------------|
| | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. |
| San Joaquin Valley counties: | | | | | | | | | |
| Fresno..... | 401,408 | 497,094 | 898,502 | 23 | 24 | 47 | 5.6 | 4.8 | 5.2 |
| Kern..... | 201,567 | 255,327 | 456,894 | 16 | 19 | 35 | 7.9 | 7.4 | 7.6 |
| Kings..... | 85,040 | 101,140 | 186,180 | 23 | 5 | 28 | 27.6 | 4.8 | 15.0 |
| Maricra..... | 43,065 | 48,140 | 91,205 | 1 | 1 | 2 | 2.3 | 2.1 | 2.2 |
| Merced..... | 79,370 | 94,390 | 173,760 | 11 | 4 | 15 | 13.9 | 4.2 | 8.6 |
| San Joaquin..... | 263,003 | 301,684 | 564,687 | 21 | 6 | 27 | 8.0 | 1.9 | 4.8 |
| Stanislaus..... | 120,547 | 153,386 | 273,933 | 7 | 4 | 11 | 5.8 | 2.6 | 4.0 |
| Tulare..... | 187,640 | 230,844 | 418,484 | 18 | 10 | 28 | 9.6 | 4.3 | 6.7 |
| Total..... | 1,381,640 | 1,682,005 | 3,063,645 | 120 | 73 | 193 | 8.7 | 4.3 | 6.3 |
| Sierra counties: | | | | | | | | | |
| Amador..... | 45,593 | 45,430 | 91,023 | 13 | 3 | 16 | 28.5 | 6.6 | 17.6 |
| Calaveras..... | 46,018 | 45,855 | 91,873 | 8 | 7 | 15 | 17.4 | 15.2 | 16.3 |
| Tuolumne..... | 49,990 | 49,895 | 99,885 | 1 | 2 | 3 | 2.0 | 4.0 | 3.0 |
| Mariposa..... | 19,841 | 19,780 | 39,621 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total..... | 161,442 | 160,960 | 322,402 | 22 | 12 | 34 | 13.6 | 7.5 | 10.5 |
| Plateau counties: | | | | | | | | | |
| Alpine..... | 1,561 | 1,545 | 3,106 | 0 | 0 | 0 | 0 | 0 | 0 |
| Inyo..... | 36,460 | 43,035 | 79,495 | 1 | 0 | 1 | 2.8 | 0 | 1.3 |
| Mono..... | 10,220 | 10,210 | 20,430 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total..... | 48,241 | 54,790 | 103,031 | 1 | 0 | 1 | 2.1 | 0 | .9 |
| Coastal counties: | | | | | | | | | |
| Monterey..... | 123,646 | 135,710 | 259,356 | 0 | 1 | 1 | 0 | .7 | .4 |
| San Benito..... | 41,068 | 44,631 | 85,697 | 2 | 0 | 2 | 4.8 | 0 | 2.3 |
| San Luis Obispo..... | 98,595 | 105,546 | 204,141 | 3 | 2 | 5 | 3.0 | 1.9 | 2.4 |
| Santa Clara..... | 431,965 | 491,010 | 922,975 | 3 | 3 | 6 | .7 | .6 | .6 |
| Santa Cruz..... | 133,532 | 145,248 | 278,880 | 5 | 1 | 6 | 3.7 | .7 | 2.1 |
| Total..... | 828,804 | 922,145 | 1,751,049 | 13 | 7 | 20 | 1.6 | .8 | 1.1 |
| Grand total..... | 2,420,127 | 2,819,900 | 5,240,127 | 156 | 92 | 248 | 6.4 | 3.2 | 4.7 |

TABLE II.—*Number of deaths from malaria, and average annual death rate per 100,000 population for southern California for 10 years, 1909-1918, inclusive.*

| | Population. ¹ | | | Deaths from malaria. | | | Malaria death rate per 100,000 population (annual). | | |
|---------------------|--------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|---|----------------------|----------------------|
| | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. | 1909-1913 inclusive. | 1914-1918 inclusive. | 1909-1918 inclusive. |
| Coastal counties: | | | | | | | | | |
| Los Angeles..... | 2,724,900 | 3,570,045 | 6,294,945 | 38 | 14 | 52 | 1.3 | 0.4 | 0.8 |
| Orange..... | 181,198 | 218,515 | 399,713 | 2 | 1 | 3 | 1.0 | .5 | .7 |
| Riverside..... | 183,757 | 226,287 | 410,044 | 0 | 5 | 5 | .0 | 2.2 | 1.2 |
| Santa Barbara..... | 144,077 | 166,365 | 310,442 | 3 | 0 | 3 | 2.1 | .0 | 1.0 |
| San Diego..... | 328,298 | 411,579 | 739,877 | 3 | 2 | 5 | .9 | .5 | .7 |
| Ventura..... | 94,173 | 104,245 | 198,418 | 2 | 2 | 4 | 2.1 | 2.0 | 2.0 |
| Total..... | 3,658,403 | 4,697,036 | 8,355,439 | 48 | 24 | 72 | 1.3 | .5 | .9 |
| Desert counties: | | | | | | | | | |
| Imperial..... | 72,555 | 90,960 | 163,515 | 3 | 3 | 6 | 4.1 | 3.3 | 3.6 |
| San Bernardino..... | 301,135 | 373,990 | 675,125 | 1 | 0 | 1 | .3 | .0 | .1 |
| Total..... | 373,690 | 464,950 | 838,640 | 4 | 3 | 7 | 1.7 | .7 | .8 |
| Grand total..... | 4,030,093 | 5,161,986 | 9,192,079 | 52 | 27 | 79 | 1.3 | .5 | .9 |

¹ The population figures given are the total added populations of each year during the period and are not the actual populations. These figures are used in order to compute more conveniently the annual death rates for the periods which they cover.

TABLE III.—Occurrence and distribution of anopheline mosquitoes in middle California, based on results of malaria-mosquito survey made in 1917 and 1919.

| | Number of collections made. | Total number of mosquitoes of all species collected. | Total number of anophelines. | Total number of A. quadrimaculatus. | Total number of A. punctipennis. | Total number of A. pseudopunctipennis. | Total per cent anophelines. | Per cent A. quadrimaculatus of anophelines collected. | Per cent A. punctipennis of anophelines collected. | Per cent A. pseudopunctipennis of anophelines collected. | Annual malaria death rate per 100,000 population; average for 10 years. |
|-------------------------------------|-----------------------------|--|------------------------------|-------------------------------------|----------------------------------|--|-----------------------------|---|--|--|---|
| San Joaquin Valley counties: | | | | | | | | | | | |
| Fresno..... | 23 | 238 | 33 | 18 | 12 | 3 | 14 | 54 | 36 | 10 | 5.2 |
| Kern..... | 16 | 270 | 49 | 15 | 1 | 33 | 18 | 31 | 2 | 67 | 7.6 |
| Kings..... | 10 | 228 | 44 | 25 | 2 | 17 | 19 | 57 | 5 | 38 | 15.0 |
| Madera..... | 9 | 127 | 33 | 14 | 0 | 19 | 26 | 42 | 0 | 58 | 2.2 |
| Merced..... | 28 | 469 | 200 | 122 | 12 | 66 | 43 | 61 | 6 | 33 | 8.6 |
| San Joaquin..... | 32 | 356 | 113 | 93 | 2 | 18 | 32 | 82 | 2 | 16 | 4.8 |
| Stanislaus..... | 9 | 123 | 33 | 14 | 1 | 18 | 27 | 42 | 3 | 55 | 4.0 |
| Tulare..... | 22 | 401 | 140 | 49 | 37 | 54 | 35 | 35 | 26 | 39 | 6.7 |
| Total..... | 149 | 2,212 | 645 | 350 | 67 | 228 | 29.1 | 54.3 | 10.4 | 35.3 | 6.3 |
| Sierra counties: | | | | | | | | | | | |
| Amador..... | 3 | 30 | 7 | 0 | 7 | 0 | 23 | 0 | 100 | 0 | 17.6 |
| Calaveras..... | 4 | 37 | 29 | 0 | 3 | 26 | 78 | 0 | 10 | 90 | 16.3 |
| Tuolumne..... | 6 | 63 | 15 | 0 | 7 | 8 | 24 | 0 | 47 | 53 | 3.0 |
| Mariposa..... | 6 | 58 | 31 | 0 | 0 | 31 | 53 | 0 | 0 | 100 | 0.0 |
| Total..... | 19 | 188 | 82 | 0 | 17 | 65 | 43.1 | 0 | 20.7 | 79.3 | 10.5 |
| Plateau counties: | | | | | | | | | | | |
| Alpine..... | 2 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Inyo..... | 5 | 42 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1.3 |
| Mono..... | 4 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Total..... | 11 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | .9 |
| Coastal counties: | | | | | | | | | | | |
| Monterey..... | 5 | 22 | 19 | 3 | 0 | 16 | 86 | 16 | 0 | 84 | 0.4 |
| San Benito..... | 4 | 47 | 28 | 9 | 0 | 19 | 60 | 32 | 0 | 68 | 2.3 |
| San Luis Obispo..... | 7 | 66 | 39 | 15 | 0 | 24 | 59 | 38 | 0 | 62 | 2.4 |
| Santa Clara..... | 14 | 170 | 46 | 21 | 11 | 14 | 27 | 46 | 24 | 30 | 0.6 |
| Santa Cruz..... | 4 | 28 | 14 | 4 | 0 | 10 | 50 | 29 | 0 | 71 | 2.1 |
| Total..... | 34 | 333 | 146 | 52 | 11 | 83 | 43.8 | 35.6 | 7.5 | 56.8 | 1.1 |
| Grand total..... | 213 | 2,803 | 873 | 402 | 95 | 376 | 31.1 | 46.0 | 10.9 | 43.1 | 4.7 |

TABLE IV.—Occurrence and distribution of anopheline mosquitoes in southern California, based on results of malaria-mosquito survey made in 1917 and 1919.

| | Number of collections made. | Total number of mosquitoes of all species collected. | Total number of anophelines. | Total number of A. quadrimaculatus. | Total number of A. punctipennis. | Total number of A. pseudopunctipennis. | Total per cent anophelines. | Per cent A. quadrimaculatus of anophelines collected. | Per cent A. punctipennis of anophelines collected. | Per cent A. pseudopunctipennis of anophelines collected. | Annual malaria death rate per 100,000 population; average for 10 years. |
|--------------------------|-----------------------------|--|------------------------------|-------------------------------------|----------------------------------|--|-----------------------------|---|--|--|---|
| Coastal counties: | | | | | | | | | | | |
| Los Angeles..... | 9 | 55 | 2 | 0 | 0 | 2 | 4 | 0 | 0 | 100 | 0.8 |
| Orange..... | 3 | 18 | 9 | 8 | 0 | 1 | 50 | 90 | 0 | 11 | 0.7 |
| Riverside..... | 8 | 117 | 89 | 43 | 1 | 45 | 76 | 48 | 1 | 51 | 1.2 |
| Santa Barbara..... | 9 | 98 | 37 | 1 | 0 | 36 | 38 | 3 | 0 | 97 | 1.0 |
| San Diego..... | 20 | 258 | 140 | 13 | 0 | 127 | 54 | 9 | 0 | 91 | 0.7 |
| Ventura..... | 13 | 152 | 101 | 49 | 0 | 52 | 55 | 48 | 0 | 52 | 2.0 |
| Total..... | 62 | 728 | 378 | 114 | 1 | 263 | 51.9 | 30.2 | 0.2 | 69.6 | 0.9 |
| Desert counties: | | | | | | | | | | | |
| Imperial..... | 5 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3.6 |
| San Bernardino..... | 4 | 51 | 26 | 9 | 0 | 17 | 51 | 35 | 0 | 65 | 0.1 |
| Total..... | 9 | 86 | 26 | 9 | 0 | 17 | 30 | 35 | 0 | 65 | 0.8 |
| Grand total..... | 71 | 814 | 404 | 123 | 1 | 280 | 49.6 | 30.5 | 0.2 | 69.3 | 0.9 |

TABLE V.—Table of summaries showing occurrence and distribution of anopheline mosquitoes in California and the average annual malaria death rate per 100,000 population for 10 years, 1909–1918, inclusive.

| | Number of collections made. | Total number of mosquitoes of all species collected. | Total number of anophelines. | Total number of <i>A. quadrimaculatus</i> . | Total number of <i>A. punctipennis</i> . | Total number of <i>A. pseudopunctipennis</i> . | Total per cent anophelines. | Per cent <i>A. quadrimaculatus</i> of anophelines collected. | Per cent <i>A. punctipennis</i> of anophelines collected. | Per cent <i>A. pseudopunctipennis</i> of anophelines collected. | Annual malaria death rate per 100,000 population; average for 10 years (1909–1918, inclusive). |
|---|-----------------------------|--|------------------------------|---|--|--|-----------------------------|--|---|---|--|
| Sacramento Valley counties ¹ ... | 97 | 1,066 | 560 | 460 | 38 | 62 | 52.5 | 82.1 | 6.8 | 11.1 | 10.9 |
| San Joaquin Valley counties.... | 149 | 2,212 | 645 | 350 | 67 | 228 | 29.1 | 54.3 | 10.4 | 35.3 | 6.3 |
| Sierra counties: | | | | | | | | | | | |
| Northern..... | 48 | 330 | 139 | 22 | 93 | 24 | 42.1 | 15.8 | 66.9 | 17.3 | 9.1 |
| Middle..... | 19 | 188 | 82 | 0 | 17 | 65 | 43.1 | 0 | 20.7 | 79.3 | 10.5 |
| Plateau counties: | | | | | | | | | | | |
| Northern..... | 15 | 239 | 28 | 28 | 0 | 0 | 11.7 | 100 | 0 | 0 | 3.5 |
| Middle..... | 11 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.9 |
| Coastal counties: | | | | | | | | | | | |
| Northern..... | 78 | 637 | 120 | 21 | 11 | 88 | 18.8 | 17.5 | 9.1 | 73.4 | 0.9 |
| Middle..... | 34 | 333 | 146 | 52 | 11 | 83 | 43.8 | 35.6 | 7.5 | 56.8 | 1.1 |
| Southern..... | 62 | 728 | 378 | 114 | 1 | 263 | 51.9 | 30.2 | 0.2 | 69.6 | 0.9 |
| Northern California..... | 289 | 2,769 | 1,052 | 661 | 159 | 232 | 38 | 62.8 | 15.1 | 22.1 | 4.9 |
| Middle California..... | 213 | 2,806 | 873 | 402 | 95 | 376 | 31.1 | 46.0 | 10.9 | 43.1 | 4.7 |
| Southern California..... | 71 | 814 | 404 | 123 | 1 | 280 | 49.6 | 30.5 | 0.2 | 69.3 | 0.9 |
| Grand total for State..... | 573 | 6,389 | 2,329 | 1,186 | 255 | 888 | 36.4 | 50.9 | 11.0 | 38.1 | 2.9 |

¹ Summary for these counties as well as for the other northern groups is taken from the report on northern California, loc. cit.

Summary and Conclusions.

Comparing the average annual death rate per 100,000 population of northern California and middle California (Table V), it will be seen that the rate is almost the same, namely, 4.9 for the former and 4.7 for the latter. Furthermore, the percentage of anophelines taken in both divisions of the State is not widely divergent, being 38 per cent in the northern and 31.1 per cent in the middle section; and of these, *A. quadrimaculatus* and *A. punctipennis* combined represented 77.9 per cent of the total in the northern division and 56.9 per cent in the middle division, the remainder being *A. pseudopunctipennis* believed to be negligible as a factor in malaria. These figures stand in rather striking contrast to those of the southern California section, where the average annual malaria death rate is only 0.9 per 100,000 population, and where 49.6 per cent of the mosquitoes collected were anophelines, of which 69.3 per cent were *A. pseudopunctipennis*. It will also be seen that the average number of mosquitoes per collection for these two divisions (northern and middle) was 9.6 for northern California and 13.1 for middle California, indicating a greater abundance of mosquitoes for the latter; but it is interesting to note that the relative number of *A. quadrimaculatus* and *A. punctipennis* com-

bined per collection for these areas was very close, being 2.9 for the northern and 2.3 for the middle area and corresponding more or less closely in proportion to the malaria death rates. The average number of mosquitoes per collection for southern California was 11.4, while the average number per collection of *A. quadrimaculatus* and *A. punctipennis* combined was only 1.7 and the malaria death rate was 0.9 per 100,000.

Although the San Joaquin Valley is commonly regarded as not greatly unlike the Sacramento Valley topographically, it will be seen that the annual malaria death rate for the latter is almost twice as high as the former, being 6.3 per 100,000 for the San Joaquin and 10.9 for the Sacramento Valley. It would appear that this high rate for the latter is explained by the high rate of effective anopheline carriers, since 46.7 per cent of all mosquitoes taken in the Sacramento Valley were *A. quadrimaculatus* and *A. punctipennis* combined, and only 18.8 per cent of all mosquitoes taken in the San Joaquin Valley were of these two species.

While the two groups of Sierra counties, northern and middle, show an approximately equal malaria death rate, namely 9.1 for the former and 10.5 for the latter, there is much divergence in the anopheline mosquito population as indicated by the collections. Owing to a time limit in carrying on the survey during 1919, the middle Sierra counties were not as well covered as had been contemplated; and in the second place, Mariposa County, herein included, presents great variations both in faunal and topographic conditions, factors which are not easily overcome in a classification based on county lines. In spite of this, there is, nevertheless, a high percentage of *A. punctipennis*.

The coastal counties, northern, middle, and southern, show a much more consistent rate both for malaria and for anophelines, i. e., a very low malaria rate and a very high percentage of *A. pseudopunctipennis*, the predominant anopheline.

That the relation between potentially effective anopheline carriers alone and the malaria rate should not be pressed too hard is indicated by the fact that the combined *A. quadrimaculatus* and *A. punctipennis* rate for the San Joaquin Valley stands at 18.8 per cent, with a malaria death rate of 6.3 per 100,000 population, while southern California has a combined *A. quadrimaculatus* and *A. punctipennis* rate of 15.2 per cent and a malaria death rate of only 0.9 per 100,000. In other words, if the potentially effective anopheline rate alone were a sufficient indicator of malaria incidence, southern California should have a much higher rate than it actually has. This seeming discrepancy is readily explained by the fact that the two areas in question are in reality not comparable because of divergent fundamental physical factors which control biological

phenomena. For example, one may travel many miles in the more arid parts of southern California without encountering mosquitoes of any kind, and then he may come to a locality where he suddenly finds them in considerable numbers. They occur in isolated and widely separated spots. Thus, for example, after many miles of travel and careful but unsuccessful search, our party rather suddenly encountered enormous numbers of *A. quadrimaculatus* at a hot springs resort in Riverside County, in a district removed from centers of population. Again, many of the anophelines (*A. quadrimaculatus*) in the southern part of the State were taken in Ventura County, particularly near the city of Ventura where the evening temperature is uniformly quite low, vitally influencing biological interrelationships. The transmission of malaria is dependent upon a combination of factors in addition to the presence of potentially effective mosquito carriers, among them being temperature (both above and below a certain range), proximity of population to anopheline foci, a sufficient production of anophelines, etc.

In spite of seemingly favorable conditions and a careful search for specimens, no anophelines were encountered in the Imperial Valley or in the upper Owens River Valley. It is quite probable that a more extensive search in both Imperial and Inyo Counties may reveal these mosquitoes.

From an examination of the average annual malaria death rates per 100,000 population for the several counties included in this report, it will be seen that the five middle California counties which have the highest rates for the 10-year period, 1909-1918, inclusive, are Amador 17.6, Calaveras 16.3, Kings 15, Merced 8.6 and Kern 7.6. It is of interest to note the shifting in relative position when comparison is made, based on the 2 five-year periods 1909-1913, inclusive, and 1914-1918, inclusive. For the period 1909-1913, inclusive, the order is, Amador 28.5, Kings 27, Calaveras 17.4, Merced 13.9, and Tulare 9.6; while for the period 1914-1918, inclusive, it is, Calaveras 15.2, Kern 7.4, Amador 6.6, Kings 4.8, and Fresno 4.8. Although a notable reduction has been made in the malaria death rate, 3 of the 5 counties still head the list of middle California counties, and 2 of the 5 take rank with the 10 counties having the highest malaria death rate in the State (five-year period, 1914-1918, inclusive), namely, Calaveras third, and Kern ninth place. Amador, Kings, and Fresno counties take their places with the 15 counties having the highest malaria death rate in the State, ranking eleventh, fourteenth, and fifteenth, respectively.